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INSTRUCTIONAL SUPPORT FEATURE GUIDELINES UTILIZATION
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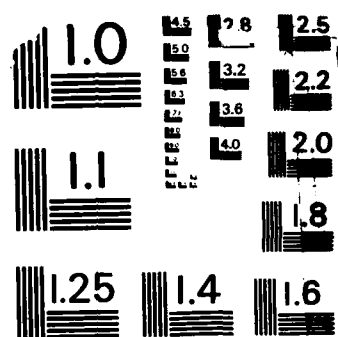
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The Public Affairs Office has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

HAROLD G. JENSEN, Colonel, USAF
Commander

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<p>This report provides a utilization assessment of the Instructional Support Feature (ISF) Guidelines developed by the Air Force Human Resources Laboratory in coordination with the Aeronautical Systems Division (ASD). The purpose of these guidelines is to enhance the instructional component of aircrew training devices by providing a better understanding of ISFs and communicating training requirements of the operational users to Simulator Systems Program Office and contractor personnel. The definition portion of the guidelines has been incorporated by ASD into a military standard. Various organizations involved in defining training requirements, in writing procurement specifications, and in system development were contacted to determine their utilization of the ISF Guidelines. Although the responses were varied, a majority of the users contacted stressed the usefulness of the ISF Guidelines as a reference document. It was frequently stated that these guidelines help to standardize the terminology, thus enhancing communication among those involved in the acquisition process.</p>					
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May 1987

INSTRUCTIONAL SUPPORT FEATURE GUIDELINES:
UTILIZATION ASSESSMENT

Douglas E. Blair

PLANS AND OPERATIONS OFFICE
Brooks Air Force Base, Texas 78235-5601



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Reviewed and submitted for publication by

Herbert J. Clark
Director, Plans and Operations Office

This is a Special Report prepared for Headquarters, Air Force Systems Command.

EXECUTIVE SUMMARY

Objective

This report provides a utilization assessment of the Instructional Support Feature (ISF) Guidelines developed by the Air Force Human Resources Laboratory, Operations Training Division (AFHRL/OT). Various organizations involved in defining training requirements, in writing procurement specifications, and in system development were contacted to determine their utilization of the ISF Guidelines.

Requirement

A research and development (R&D) effort was coordinated by AFHRL/OT and the Aeronautical Systems Division (ASD), with input from major commands (MAJCOMs), to provide guidelines for use in the development of specifications for the instructional component of aircrew training devices (ATDs). The formal requirements for this R&D were Request for Personnel Research (RPR) 76-20, Aircrew Performance Measurement System, and Technology Need (TN) ASD-0509-82-63, Flight Simulator Performance Metrics.

Products

Two AFHRL technical reports (TRs) resulted from this R&D effort, of which the ISF guide is the primary product. Documentation of the R&D is contained in AFHRL-TR-85-57(I), Development of Instructor Support Feature Guidelines. AFHRL-TR-85-57(II), Instructor Support Feature Guidelines, provides procedures for analyzing training and instructor support requirements, provides descriptions of ISFs, and describes current system capabilities. The ISF definition portion of the guidelines has been incorporated by ASD into the following military standard: MIL-S-8724, Military Specification, Simulator Flight, 31 December 1985.

Specifics

The ISF guide was developed under work unit 2359-01-06, Performance Measurement System for Aircrew Training Devices (PE 63751F). The work unit was approved in October 1983, contracted with Logicon Inc. in May 1984, and closed out as completed in February 1986. The total cost of the effort was \$449,198, of which ASD provided \$100,000.

Assessment Results

A number of organizations involved in the development and use of ATDs were surveyed concerning utilization of the ISF Guidelines. Although some individuals indicated that the guide has limited application, a majority of the users contacted stressed its usefulness as a reference document, particularly for definitions and applications of ISFs. It was frequently stated that standardization of the terminology of ATD instructional systems facilitates the determination of what features need to be incorporated in ATDs to satisfy the training requirements specified by operational users. The ISF Guidelines are only a part of the total documentation needed in the development and acquisition of the instructional component of an ATD. Considering its usefulness as a reference document and its incorporation into a military standard, the ISF guide is a success. For continued effectiveness, the guidelines need to be continually updated to transition lessons learned and incorporate technology advances in instructional systems.

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INSTRUCTIONAL SUPPORT FEATURE GUIDELINES: UTILIZATION ASSESSMENT

I. INTRODUCTION

Aircrew Training Devices (ATDs) have two main components: the simulation system and the instructional system. The simulation component focuses primarily on issues regarding the degree of fidelity in reproduction of the aircraft and flight environment. The instructional component provides those capabilities necessary to make the simulator a training device, through instructional support features (ISFs) designed to enhance the training process. Through an instructor/operator station (IOS), the instructor can use the ISFs to create, control, monitor, and record flight training missions. Appendix A lists available ISFs, organized according to the functions they perform and in the order they would most likely be used. When properly designed and utilized, these features greatly reduce the workload involved in conducting training exercises and enable the ATD instructor to more effectively control and monitor student activities. However, instructional systems have not always been developed according to the users' needs. In early attempts to build ATDs, there had frequently been an emphasis on developing comprehensive instructional systems which supported every aspect of instruction, instead of training devices designed to meet specific student training needs and instructor requirements. This has resulted in a multiplicity of systems that are not responsive to the instructors' needs and are often difficult to use and understand.

The document entitled "Instructor Support Feature Guidelines" was developed to enhance the instructional support of ATDs; i.e., to provide a better understanding of ISFs and to communicate the operational requirements for ISFs to personnel involved in the acquisition process. These personnel include operational users at the Air Force major commands (MAJCOMs) who initially state training requirements, Simulator Systems Program Office (SimSPO) personnel involved in the final specification definition, and contracting personnel involved in system development.

II. BACKGROUND

In response to a recognized need for guidelines that might be applied in the development of specifications for the instructional component of ATDs, a research and development (R&D) effort was jointly coordinated by the Air Force Human Resources Laboratory, Operations Training Division (AFHRL/OT), Williams AFB, Arizona; Headquarters Military Airlift Command (HQ MAC), Scott AFB, Illinois; and Air Force Systems Command, Aeronautical Systems Division (AFSC/ASD), Wright-Patterson AFB, Ohio. Although this R&D effort stemmed from the development of the performance measurement system for the C-5 flight simulator, because of the generic nature of the system architecture, the specifications have applicability to a wide variety of ATDs from Tactical Air Command (TAC), Strategic Air Command (SAC), and Air Training Command (ATC). The formal requirements for this R&D were Request for Personnel Research (RPR) 76-20, Aircrew Performance Measurement System (MAC/DOTF), and Technology Need (TN) ASD-0509-82-63, Flight Simulator Performance Metrics (ASD/EN, ASD/YNE). This advanced development effort (PE 63751F) was accomplished as part of AFHRL/OT's training effectiveness plan, under work unit 2359-01-06, Performance Measurement System for Aircrew Training Devices. The work unit was validated 20 December 1982, approved 20 October 1983, contracted with Logicon Inc. on 1 May 1984, and completed 30 September 1985. The products of this R&D effort consist of the following technical reports (TRs):

1. Easter, A.W., Kryway, J.T., Olson, W.R., Peters, S.M., Slemon, G.K., & Obermayer, R.W. (1986a). Development of instructor support feature guidelines (AFHRL-TR-85-57(1), AD-A168 308). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory.

2. Easter, A.W., Kryway, J.T., Olson, W.R., Peters, S.M., Slemon, G.K., & Obermayer, R.W. (1986b). Instructor support feature guidelines (AFHRL-TR-85-57(II), AD-A168 285). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory.

The R&D that led to the development of the ISF Guidelines is documented in AFHRL-TR-85-57(I). The ISF Guidelines, which provide procedures for analyzing training and instructor support requirements to specify instructor support systems, provide descriptions of available ISFs, and describe current system capabilities, are contained in AFHRL-TR-85-57(II).

Exploratory development work (PE 62205F), which provided the data base for development of the ISF Guidelines, was conducted under work unit 1123-03-58, Flying Training Research Support Services. Surveys were conducted (a) to document the utility and utilization of advanced instructional features (AIFs) in ATDs, (b) to compare AIF utility and utilization in replacement and continuation training units, and (c) to provide a data base for defining requirements for future ATD procurements and for developing subsequent training programs using ATDs. The results of these surveys, documented in the TRs listed below, indicated that most instructors receive little training in AIF use and that most of the features are not used very often.

1. Polzella, D.J. (1983). Aircrew training devices: Utility and utilization of advanced instructional features (Phase I - Tactical Air Command) (AFHRL-TR-83-22, AD-A135 052). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory.
2. Polzella, D.J. (1986). Aircrew training devices: Utility and utilization of advanced instructional features (Phase II - Air Training Command, Military Airlift Command, and Strategic Air Command) (AFHRL-TR-85-48, AD-A166 726). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory.
3. Polzella, D.J., & Hubbard, D.C. (1986). Aircrew training devices: Utility and utilization of advanced instructional features (Phase III - Electronic warfare trainers) (AFHRL-TR-85-49, AD-A167 922). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory.
4. Polzella, D.J., & Hubbard, D.C. (In press). Aircrew training devices: Utility and utilization of advanced instructional features (Phase IV - Summary Report) (AFHRL-TR-87-XX). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory. This report is currently in draft review.

Other exploratory development work at AFHRL (PE 62205F) involving the instructional component of ATDs is being conducted under work unit 1123-03-79, Flying Training Research Support, and will be documented in the following report:

1. Warner, H.D. (In press). Instructor operator station design handbook for aircrew training devices (AFHRL-TR-87-XX(I)). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory. This volume is currently in draft review.
2. Charles, J. (In press). Instructor operator station design guide (AFHRL-TR-87-XX(II)). Williams AFB, AZ: Operations Training Division, Air Force Human Resources Laboratory. This volume is currently in draft review.

Volume I, the IOS Design Handbook, provides the human factors/engineering-type data required to develop IOS design specifications. Volume II, the IOS Design Guide, is designed to assist the user in determining what type of IOS is required, based on the type of ATD.

These volumes are designed to be used independently or in conjunction with the ISF Guidelines. The overall goal is to improve the effectiveness of ATDs, with special emphasis on ensuring that the instructional features selected address the training requirements and are accurately described in the procurement specifications.

III. DEVELOPMENT COST

Work unit 2359-01-06 was formally closed out on 18 February 1986. Job Order Cost Accounting System (JOCAS) data indicate that the total cost of the ISF Guidelines effort was \$449,198, of which ASD provided \$100,000.

IV. RESULTS

Assessment Methodology

User organizations (i.e., organizations involved in defining training requirements, in writing procurement specifications, and in systems development) were surveyed from August to December 1986 to determine their utilization of the ISF Guidelines. Eighteen R&D Product Utilization Assessment surveys were sent by letter to 14 organizations, and followed up by telephone and/or personal visits. A copy of the survey is shown in Appendix B. Twelve surveys were returned from 10 organizations. A listing of organizations that provided utilization information is shown in Appendix C. The responses provided were individual opinion and are not necessarily representative of the organization with which the individual is associated. However, responses are documented by organization as a matter of convenience.

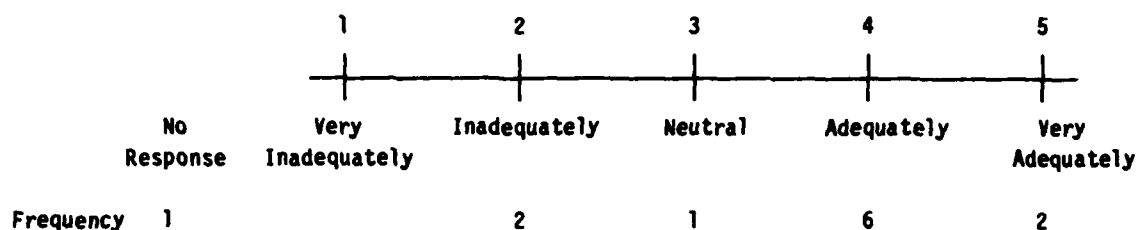
Implementation Assessment

The ISF Guidelines document was designed for use by MAJCOM requirements personnel, SimSPO specification writers, ATD users, and contractor personnel. When it was published in May 1986, approximately 250 copies were printed. In addition to the copies sent to AFHRL Primary Distribution List addressees, approximately 10 copies were sent to ASD/YWE, 15 copies to USAFTAWC, and 50 copies to AFHRL/OT for special distribution to user organizations. As the primary requirements manager, ASD/YWE is the responsible office for ensuring that the guidelines are distributed to users. This organization is also listed in the ISF Guidelines as the point of contact for obtaining additional copies. ASD/YWE indicated that at the completion of the contract, they sent copies of the Guidelines, some in draft form, to USAFTAWC, HQ SAC/DOTP, and seven contractors involved in ATD development. As of January 1987, AFHRL/OT had sent approximately 30 copies to users upon request, and AFHRL/XO had sent 10 copies to individuals who either had not received copies from ASD or were requesting additional copies.

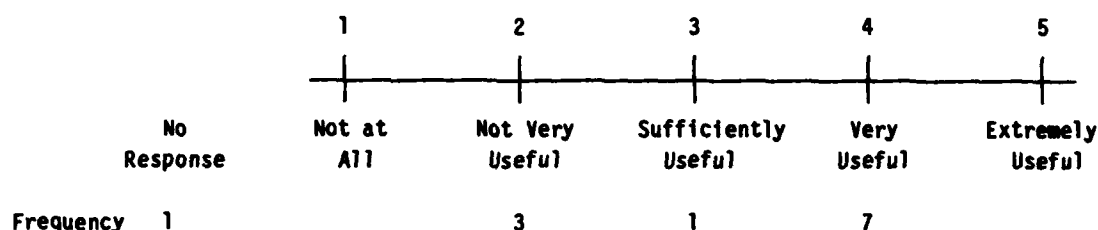
The amount of utilization and degree of usefulness of the ISF Guidelines reported varied considerably among the individuals who responded to the survey. This is illustrated by the response frequencies for the scaled questions shown in Figure 1.

The responses indicate that seven of the twelve individuals felt that the ISF Guidelines were useful and were being used at least moderately within their organizations. One individual who had just received a copy reported that the document had not been used very much but indicated that it would likely be used in the future. Overall, seven organizations (nine individuals) had very positive comments; only three individuals (HQ MAC/DOT, USAFTAWC/TN, and McDonnell-Douglas Helicopters) had unfavorable comments.

1. To what extent were the needs of your organization addressed during this R&D effort?



2. How useful is this product to your organization?



3. To what extent is the R&D product being used by your organization?

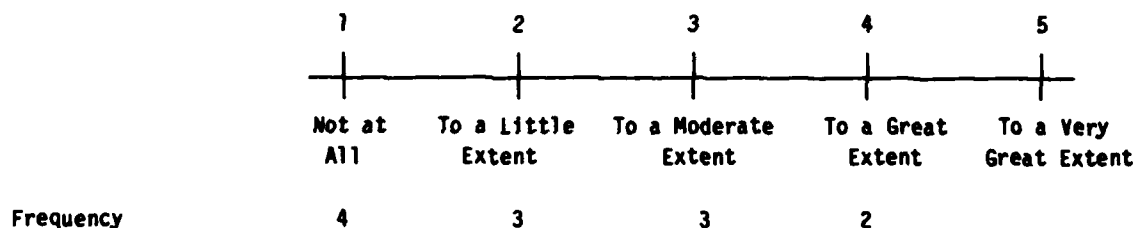


Figure 1. Response Frequencies for Utilization Assessment Question.

Four organizations who responded favorably either had used or were presently using the ISF Guidelines in the design of specific ATDs, as indicated below:

A-6F/F-14D (Navy) Operational Flight Trainer (Boeing Military Airplane Company)
 C-130 Aircrew Training System (Boeing Military Airplane Company)
 F-15E Weapon System Trainer (Goodyear Aerospace Corporation)
 F-16 Operations Flight Trainer (Singer-Link Division)
 Modular Instructor Operator Station (Harris Corporation)

It was commonly stated (by ASD/YWE and six contractors) that the ISF Guidelines document is a very good source reference, in that it standardizes definitions and applications of ISFs. It also provides lessons learned from previous applications, which is useful in avoiding potential design problems and expenditure of time and money on research required to determine what features to implement. It was frequently stated that standardization of the ATD terminology was long overdue. The standardization of terms facilitates the determination of what features need to be incorporated in ATDs to satisfy the training requirements specified by operational users.

One negative comment (MAC/DOT) was that the guidelines do not provide adequate supporting information to justify the costs of ISFs. Provision of supporting data for cost justification purposes was not an objective of the guidelines. However, as part of their overall training effectiveness plan, AFHRL/OT is currently developing software modules that will address the cost

and training effectiveness of ISFs, based on training requirements. Another comment by MAC was that much of the information contained in the guidelines is common knowledge. In discussing the usefulness of the ISD Guidelines as a reference document, most of the other organizations seemed to disagree. As an example, a user at Reflectone made the following statement: "Previously this information was only available through many years of experience and detailed conversations with the users." A final concern expressed by MAC was that the ISF Guidelines may be overcome by events and thus become no longer necessary. Two reasons were given: First, ATD hardware requirements are no longer stated in MAC's Requests for Proposal (RFPs); only the training requirements are specified. The contractors have the prerogative to decide on the ATD configuration as long as the device proves training effective. Second, the Air Force now contracts out weapon system training programs; therefore, the MAJCOMs will no longer require the ISF Guidelines to state their training requirements. AFHRL/OT's reply to these two comments is as follows: First, the ISF Guidelines primarily address software requirements; only rarely mentioned is the hardware configuration that is required to support the software. Second, the ISF Guidelines would still be of use to the contractors who develop the weapon system training programs.

Another criticism (USAF/TAC/TN) was that the guidelines have a limited application. Another individual (McDonnell-Douglas Helicopters) said that the guidelines have a fixed-wing orientation and deal only with traditional ISFs at the undergraduate pilot training level. Followup discussions with AFHRL/OT, ASD/YWE, and several contractors failed to support this interpretation. The majority opinion was that the ISF guide is generic and can be used in fixed-wing, rotorcraft, and even maintenance training applications.

V. RECOMMENDATIONS

The organizations contacted for this utilization assessment made various recommendations either as ways of improving the current product or as follow-on R&D that would be beneficial. Their recommendations are indicated below. Recommendations 1 through 4 focus on ways to improve the current guidelines; 5 through 9 pertain to follow-on R&D.

1. Include in the guidelines the rationale for incorporating advanced training features, their advantages, and the cost savings that will result from their use.

2. Integrate human engineering design specifications with the ISF Guidelines.

3. Extend the scope of the guidelines to tactical-level applications, including novel applications to multiship use and features specific to the engineering development environment.

4. Incorporate in the guidelines more sections with examples of actual instructor consoles and implementation details.

5. Conduct training effectiveness and performance measurement R&D on the design requirements advocated by the IOS Design Guide.

6. Investigate design errors in existing weapon system trainers and publish information on lessons learned and how the problems were corrected.

7. Investigate how an instructor/organization might best use artificial intelligence features.

8. Collect field data on actual use of instructional features and user acceptance.

9. Assess commonalities between the ISF effort and ASD's modular simulator design program.

During the development phase, it was concluded that the ISF Guidelines should be maintained as a dynamic, "living" document; i.e., the guidelines must be continually updated to effectively transition lessons learned and incorporate technology advances. However, who is responsible for ensuring that the document is updated on a timely basis and the information is correct? How will these updates be made on a continuing basis? What action should be taken to correct some minor mistakes contained in the current version of the guidelines? The problem of keeping the guidelines current was partially addressed by making the document available on a diskette so that each using organization can make updates or corrections whenever appropriate. However, ASD reports that they have sent only two or three diskettes to users. From various discussions, it seems apparent that most users are not aware of the diskette's existence. As the primary requirements manager, ASD/YWE seems the appropriate agency for informing users of the diskette's availability for distribution upon request.

At the beginning of this utilization assessment, it was discovered that some of the users on the ASD distribution list had not received their copies of the ISF Guidelines. Being primarily responsible for distribution of the guidelines, how should ASD/YWE ensure that the users are familiar with the document? MAC/DOT recommended that the guidelines be referenced in RFPs, to ensure that all organizations responding to an RFP would use the document. In addition to using the ISF Guidelines Air Force wide, one contractor recommended that the other services look at the document and either endorse it or write their own.

VI. CONCLUSIONS

The stated purpose of the ISF Guidelines is to promote a better understanding of ISFs and their uses. Throughout the document, the emphasis is on meeting the functional needs of the instructor rather than the application of state-of-the-art technology. Although there were some differences of opinion, the majority of users contacted stressed the usefulness of the guidelines as a reference document that provides definitions of ISFs which standardize much of the terminology. This in turn enhances communication among the operational users at the MAJCOMs, SimSPO personnel, and contractor personnel. The ISF definition portion of the guidelines has been incorporated by ASD into the following military standard: MIL-S-8724, Military Specification, Simulator Flight, 31 December 1985. Considering the primary objective of the guidelines, the document's usefulness as a reference source, and the incorporation of the ISF definitions into a military standard, the ISF guide is judged a success.

The ISF Guidelines represent only part of the total documentation needed in the development and acquisition of the instructional component of an ATD. User expectations that the ISF Guidelines would provide more information than was intended perhaps account for many of the inadequacies expressed, such as limited application and lack of cost justification data. These perceived inadequacies are currently being addressed in follow-on work and documentation. The Instructor Operator Station Design Handbook (draft) will provide human factors/engineering-type data for the development of IOS design specifications, the Instructor Operator Station Design Guide (draft) will provide functional requirements for IOSs, and software modules currently under development will provide supporting data to justify the cost of ISFs in relation to their training effectiveness.

APPENDIX A: INSTRUCTIONAL SUPPORT FEATURES

Pre-Training Requirements

Instructor Training Function
ISF: Tutorials

Briefing Function
ISF: Briefing Utilities

Training Requirements

Control Function
ISFs: Scenario Control
Initial Conditions
Real-Time Simulation Variables Control
Malfunction Control
Reposition

Monitor Function
ISFs: IOS Display Control and Formatting
Procedures Monitoring

Instruct Function
ISFs: Freeze
Simulator Record/Replay
Automated Simulator Demonstration

Evaluation Function
ISF: Automated Performance Measurement

Post-Training Requirements

Debriefing Function
ISFs: Hardcopy/Printout
Remote Graphics Replay

Recording Function
ISF: Data Storage and Analysis

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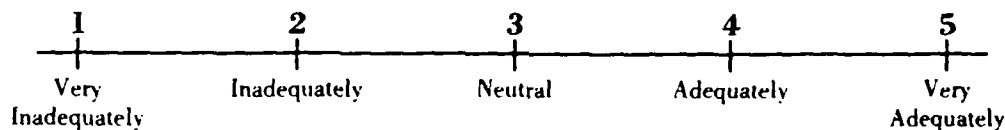
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R&D PRODUCT UTILIZATION ASSESSMENT

The Plans and Operations Office of the Air Force Human Resources Laboratory (AFHRL) is responsible for tracking the utilization of AFHRL's research and development efforts. Your responses are needed to assess the utilization of:

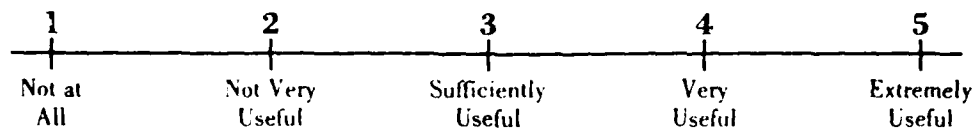
Note: For each scaled question, please circle the appropriate number and comment further as you desire. If necessary, attach additional page for your comments.

1. To what extent were the *needs* of your organization addressed during this R&D effort?



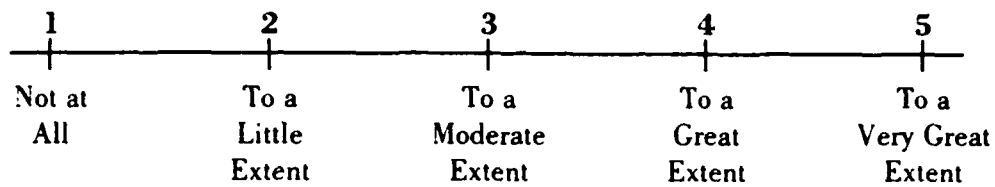
Comments: (Please be as specific as you can.)

2. How *useful* is this product to your organization?



Comments: (Please be as specific as you can.)

3. To what extent is the R&D product being *used* by your organization?



Comments: (If the product is not being used, please explain why this is the case. If it is used, please specify any concrete benefits, e.g., cost savings, increased operational effectiveness, improved force structure. Also, if possible, please include the time required for implementation, the cost of implementation and any barriers to implementation/utilization.)

4. Please identify (name/office symbol) other organizations that *currently* use this product.

____ Unknown

5. Please specify any *additional possible* uses for this product.

____ Unknown

6. Please identify (name/office symbol) other organizations that *could* possibly use this product.

____ Unknown

7. What follow-on R&D would your organization consider potentially beneficial?

____ Unknown

8. Please comment additionally on this product (*relevance, timeliness, clarity, completeness, etc.*).

9. Please complete the following information:

ORGANIZATION/OFFICE SYMBOL: _____

NAME: _____ RANK or GRADE: _____
Person completing survey

POSITION: _____

AUTOVON/COMMERCIAL PHONE NUMBER: _____

ADDRESS: _____
Street or P.O. Box

City or Base State Zip

THANK YOU FOR PROVIDING THIS INFORMATION.

AUTHORITY: 10 U.S.C. 8012 Secretary of the Air Force, Powers, Duties,
Delegation by Compensation.

PRINCIPAL PURPOSE: The information provided will be used solely for Air Force
management purposes related to R&D utilization.

ROUTINE USES: To provide feedback to the Laboratory on the utilization of R&D
products.

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APPENDIX C: ORGANIZATIONS PROVIDING UTILIZATION INFORMATION

Requirements Organizations

ASD/YNEE: Aeronautical Systems Division, Deputy for Simulators, Training System Engineering, Engineering Branch

HQ MAC/DOT: Headquarters Military Airlift Command, Directorate of Training

Additional Organizations

USAF TAWC/TN: United States Air Force Tactical Air Warfare Center,
DCS/Aircrew Training Devices

Boeing Military Airplane Company, Simulation and Training Systems, Huntsville AL

Cubic Defense Systems, San Diego CA

Goodyear Aerospace Corporation, Akron OH

Harris Corporation, Winter Park FL

McDonnell-Douglas Helicopters, Engineering and Training Simulation Department, Mesa AZ

Reflectone, Displays System Engineering Department, Tampa FL

Singer-Link Division, Houston TX

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